BRIEF REPORT

Bicycle helmet prevalence two years after the introduction of mandatory use legislation for under 18 year olds in Alberta, Canada

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Objective: To determine changes in helmet use in cyclists following the introduction of a bicycle helmet law for children under age 18.
Methods: Cyclists were observed by two independent observers from July to August 2004 (post-legislation) in Edmonton, Alberta. The data were compared with a similar survey completed at the same locations and days in July to August 2000 (pre-legislation). Data were collected for 271 cyclists in 2004 and 699 cyclists in 2000.
Results: The overall prevalence of helmet use increased from 43% (95% CI 39 to 47%) in 2000 to 53% (95% CI 47 to 59%) in 2004. Helmet use increased in those under 18, but did not change in those 18 and older. In the cluster adjusted multivariate Poisson regression model, the prevalence of helmet use significantly increased for those under age 18 (adjusted prevalence ratio (APR) 3.69, 95% CI 2.65 to 5.14), but not for those 18 years and older (APR 1.17, 95% CI 0.95 to 1.43).
Conclusion: Extension of legislation to all age groups should be considered.

According to 2004 Alberta Transportation data, there were 613 cyclists injured or killed on Alberta roadways and 40% of these were under the age of 20.[1] Approximately 20% of cyclist emergency department visits are for head injuries;[2] though the proportion can rise to over 75% for those fatally injured.[3]

Evidence indicates that bike helmets prevent head, face, and brain injuries.[4 5] Two systematic reviews of the scientific evidence found that helmets reduce fatal injuries by 73%,[4] and are effective even in those crashes involving motor vehicles, reducing the risk of head injury under these circumstances by 69%.[5]

Many studies have demonstrated a post-legislation increase in the proportion of helmeted cyclists.[6–16] Among studies using direct observation of helmet use both pre- and post-legislation, only one involved age groups not affected by the law.[17] That study included a helmet giveaway program and educational component, which may have confounded the legislative effect.

We were presented with an opportunity in Alberta to examine helmet wearing rates a full two years after helmet legislation was implemented in 2002 in age groups both covered (<18 years old) and not covered (18 years and older) by the law. This evaluation is important in order to inform other jurisdictions considering whether to implement legislation and to which age groups it should apply.

METHODS

The first phase of this repeat, cross sectional survey was conducted in 2000 to estimate the prevalence of bicycle helmet use in the cities of Edmonton and Calgary, along with surrounding communities if they were within 50 km from either city center and their population exceeded 9500 (Airdrie, Cochrane, Okotoks, Fort Saskatchewan, Leduc, Sherwood Park, Spruce Grove, and St Albert).[18] These locations were divided into six strata: schools, parks, commuter routes, designated cycling paths, universities/colleges, and residential areas. One observer at each site collected information on riding companionship, helmet use of riding companions (if any), helmet use, gender, and approximate age.

During the summer of 2004, two trained observers and a project coordinator visited the same sites, in Edmonton only, on the same weekday and at the same time periods used in 2000.[18] Only those sites where at least 10 riders were observed in 2000 were visited by the team to maximize data collection efficiency. If data collection times overlapped, we chose the site where most observations were recorded.

Five sites had to be rescheduled due to inclement weather. We were unable to reschedule data collection for one site. No school observations were made in 2004 as data collection did not commence until July. Thus, in 2004 we collected data at 22 of the 23 eligible 2000 observation sites in Edmonton.

In 2004, the project coordinator directed observations on cyclists and pedestrians who passed by on the observers' side of the street, but traveling in either direction. Data were collected on age (<6, 6–12, 13–17, 18–54, and 55+), sex, helmet use, travel mode, clothing visibility, observer assessed speed, and bicycle reflective devices. This report presents cyclist data only and does not include the additional information on clothing visibility, observer assessed speed, or reflective device use. Once finished recording observations, the observers would verbally cue the project coordinator who would then direct observations on the next subject (pedestrian or cyclist).

ANALYSIS

As two estimates of helmet prevalence were available in 2004, we randomly selected which observer's data to use for each site. Interobserver agreement was assessed using Kappa (κ) for age category (<18, 18+), sex, and helmet use.

Change in helmet prevalence between 2000 and 2004 was examined by age, sex, location, and neighborhood average annual household income based on 2001 Statistics Canada census data divided into three strata: <\$50,000, \$50,000–\$59,999, and \$60,000+.[19]

Poisson regression was used to directly model the prevalence ratio,[20] with the robust (sandwich or Huber-White) estimator to account for clustering by site.[21] All analyses were conducted in Stata version 8.0.[22] Main effects and interactions between year of observation (2004 = 1; 2000 = 0) and all other variables (age: <18 = 1, 18+ = 0; sex: male = 1, female = 0; location: campus, residential, cycle

Table 1 Helmet prevalence rates by year of survey

Variable	2000 helmet prevalence		2004 helmet prevalence*		2004 *v* 2000 prevalence ratio (cluster adjusted 95% CI)
	n/N†	% (95% CI)	n/N†	% (95% CI)	
Overall	300/699	43 (39–47)	144/271	53 (47–59)	1.24 (1.02–1.50)
Age‡					
<18 total	46/164	28 (22–35)	34/41	83 (68–92)	2.96 (2.22–3.94)
<13	29/66	44 (33–56)	13/13	100	2.28 (1.58–3.29)
13–17	17/98	17 (11–26)	21/28	75 (56–88)	4.32 (2.53–7.39)
18+	234/474	49 (45–54)	110/230	48 (41–54)	0.97 (0.79–1.19)
Sex‡					
Female	89/165	54 (46–61)	50/75	67 (55–76)	1.24 (0.96–1.59)
Male	183/485	38 (34–42)	94/196	48 (41–55)	1.27 (0.95–1.71)
Location§					
Commuter route	130/353	37 (32–42)	64/121	53 (44–62)	1.44 (1.21–1.71)
Campus	22/62	36 (25–48)	9/29	31 (17–50)	0.88 (0.47–1.64)
Residential	23/65	35 (25–48)	13/21	62 (40–80)	1.75 (1.35–2.26)
Cycling path	59/114	52 (43–61)	35/61	57 (45–69)	1.11 (0.66–1.85)
Park	66/105	63 (53–72)	23/39	59 (43–73)	0.94 (0.74–1.19)
Average annual income					
<50,000	68/150	45 (38–53)	28/51	55 (41–68)	1.21 (0.997–1.47)
50,000–59,999	171/408	42 (37–47)	74/139	53 (45–61)	1.27 (1.0–1.61)
60,000+	61/141	43 (35–52)	42/81	52 (41–63)	1.20 (0.68–2.12)

*Helmet prevalence based on randomly selected observer.
†Number wearing helmet/total number of cyclists observed.
‡Missing age for 61 subjects and missing sex for 49 subjects in 2000 survey.
§No school observations made in 2004.

path, park; neighborhood average annual household income: <50,000, 50,000–59,999, 60,000+) were included. Interaction terms were simultaneously tested and those that were significant ($p<0.05$) were retained in the model.

Ethical approval was obtained from the University of Alberta Health Research Ethics Board. We notified the Edmonton Police Service about the study and provided a letter explaining the project details to concerned citizens in 2004.

RESULTS

Data were collected for 271 cyclists in 2004 and 699 cyclists in 2000. Helmet use was not recorded for two cyclists in 2000 and two cyclists in 2004 and so these observations were excluded from the analysis.

Agreement

We noted almost perfect agreement between the two observers on cyclist helmet use ($\kappa = 0.95$; 95% CI 0.86 to 1.0) and sex ($\kappa = 0.95$; 95% CI 0.84 to 1.0). We also found substantial agreement for age categories ($\kappa = 0.78$; 95% CI 0.66 to 0.89).

Table 2 Pre- versus post-legislation bicycle helmet prevalence ratios by age and location

Variable	2004 *v* 2000 adjusted* prevalence ratio (cluster adjusted 95% CI)
Age	
<18	3.69 (2.65–5.14)
18+	1.17 (0.95–1.43)
Location	
Commuter route	1.17 (0.95–1.43)
Campus	0.74 (0.49–1.11)
Residential	1.49 (1.14–1.96)
Cycling path	0.75 (0.51–1.10)
Park	0.78 (0.58–1.05)

*Poisson regression model with adjustment for clustering by site contained terms for age, date, sex, average annual income, location, and the interaction of date and location and date and age; complete case analysis based on 890 subjects (970 total subjects less 80 subjects missing data for age or sex or both).

Helmet use: unadjusted

Helmet use increased from 43% in 2000 to 53% in 2004 (table 1). Helmet prevalence increased threefold in those younger than 18; however, prevalence changed little in those 18 and older (from 49% to 48%). Helmet use was estimated to increase in residential areas and on commuter routes in both males and females, regardless of average annual income.

Helmet use: adjusted

Significant interactions were found for year of observation by age and year of observation by location. From table 2, after adjusting for sex, location, and average annual income, the prevalence of helmet use increased 3.7-fold from 2000 to 2004 for those younger than 18 years (95% CI 2.65 to 5.14). For those riders 18 years and older, the effect was less pronounced and not significant (adjusted prevalence ratio: 1.17; 95% CI 0.95 to 1.43). The prevalence of helmet use was also estimated to increase for residential neighborhoods, but not at other locations.

DISCUSSION

Our results demonstrate a significant increase in helmet prevalence following legislation in those cyclists under 18 years old and are consistent with the findings of other investigators.[6–16] Bicycle helmet evaluations in other Canadian Provinces with all-ages bicycle helmet legislation have shown a consistent increase in helmet use across age groups.[9 11] However, adjusting for trends in those aged 18 and older strengthens the findings. Considering that children riding with helmeted adults are almost 10 times more likely to be wearing a helmet than children riding with non-helmeted child companions,[23] policy makers should consider extending current children-only helmet legislation in Alberta and other locations. Moreover, regions contemplating bicycle helmet legislation should use these results to argue for universal bicycle helmet legislation.

Limitations

In the 2004 survey, the project coordinator directed observations on subjects (that is, selected which subjects to observe); however, this direction followed a standard protocol that precluded consideration of helmet wearing, but was simply based on the next subject to pass by the research team. This approach was necessary to ensure that each observer recorded information on the same cyclist in order to calculate agreement statistics. It seems unlikely that selection bias occurred under these circumstances.

There was likely some non-differential misclassification of neighborhood average annual income as we did not find that this variable modified the pre- to post-legislation assessment of bicycle helmet prevalence. This result conflicts with the findings of Parkin *et al*,[15] who noted a greater post-legislation increase in the prevalence of helmet use for low and middle socioeconomic status (SES) areas compared with high SES areas. The discrepancy is likely explained by the more sensitive definition of SES units used by Parkin *et al* and the lack of heterogeneity of neighborhood average annual income levels in our investigation.

We adjusted for most variables that have been shown to influence helmet use; however, because we did not stop cyclists and collect other information regarding personal, trip, or cycling characteristics, these influences could not be excluded. However, because we compared the change in prevalence for those younger than 18 years affected by the helmet law with similar trends for adults, it is unlikely that our results could be explained by a concomitant increase in general safety. Public helmet awareness campaigns and targeted school health activities were implemented in the spring of 2004 (Kathy Holgate, KIDSAFE Connection, Stollery Children's Hospital, personal communication), which may have increased helmet use independent of the legislative effect. Compared with legislation, though, education on its own has proven to be a less effective intervention.[7] Enforcement activities also increased in 2004 as reflected in Edmonton Police Service helmet infraction data showing 16 bicycle helmet tickets in 2003 compared with 48 in 2004 (Nancy Leake, Edmonton Police Service, personal communication). We would argue that this still represents minimal enforcement for a large urban center. Therefore, the increase in helmet prevalence for children and adolescents is likely due to the legislation—not education or enforcement.

Because we captured more information (for example, clothing color) on each cyclist, did not capture information on all cyclists, but only those passing by the research team, and recorded information on pedestrians in 2004, we cannot comment on the number of cyclists seen in 2000 and 2004.

Implications for prevention

The introduction of helmet legislation restricted to youth in Alberta was associated with an increase in helmet use for this age group, but had little effect on adult riders, suggesting that adult legislation should be considered.

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Key points

- Many studies have demonstrated a post-legislation increase in the proportion of helmeted cyclists, but few have included age groups not affected by the law.
- We noted substantial interrater agreement for helmet use, age, and sex.
- Adjusted helmet prevalence estimates increased substantially after legislation for those under 18 years old (that is, those affected by helmet legislation), but changed little for adults (that is, those not affected by the legislation).
- Adjusting the child helmet use trends for adult trends makes it unlikely that other factors besides the legislation caused the increase in helmet use seen in those under the age of 18 years.
- The results suggest that adult legislation should be considered.

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ECHO

More endoscopists improve outcome for upper GI cancer

Please visit the *Quality and Safety in Health Care* website [www.qshc.com] for a link to the full text of this article.

More endoscopists may be the answer to better outcomes for upper gastrointestinal (GI) cancer, as recent improvement seems to owe more to the introduction of nurse endoscopists than the UK government's two week wait scheme for a specialist consultation, according to doctors in one cancer unit.

True enough, the odds of curative resection increased significantly (odds ratio 1.48) in their unit in the two years after the scheme was introduced compared with the two years before, and curative resections for early (stage 1 and 2) cancers rose from 47 to 58. But only two patients (5%) of 38 diagnosed with the cancer out of 623 referred under the scheme had early stage disease compared with 56 (27%) outside it. Furthermore, just over a third of patients with early stage cancer had symptoms consistent with the referral criteria in the scheme, but only two of them were referred under it.

When the scheme was implemented at Norfolk and Norwich University Hospital, in September 2000, it coincided with appointment of two full time nurse endoscopists, which reduced routine waiting times for endoscopy—and probably accounted for the improvement.

Under the scheme guidelines for urgent referrals for upper GI cancer were issued to general practitioners to ensure timely specialist evaluation. Detecting the cancer early is key to curative treatment, but symptoms can be unreliable. This may be why reducing times for routine endoscopy may be the best option.

The UK government has been under pressure to improve its poor record on upper GI cancer outcome in western Europe.

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